

would require a great lapse of time to cause the submarine and supramarine areas to change places, even if the ascending movements in the one region and the descending in the other were continuously in one direction. But we have only to appeal to the structure of the Alps, where there are so many shallow and deep-water formations of various ages crowded into a limited area, to convince ourselves that mountain-chains are the result of great oscillations of level. High land is not produced simply by uniform upheaval, but by a predominance of elevatory over subsiding movements. Where the ocean is extremely deep it is because the sinking of the bottom has been in excess, in spite of interruptions by upheaval" (p. 124). "Movements of 1000 feet or more would turn much land into sea, and sea into land, in the continental areas and their borders; whereas oscillations of equal magnitude would have no corresponding effect in the bed of the ocean generally, believed as it is to have a mean depth of nearly 13,000 feet. The greatest depths of the sea do not exceed the greatest heights of the land; it may, therefore, seem strange that the mean depth of the sea should exceed the mean height of the land six times, even taking the lowest estimate of the ocean depths as given by the late deep-sea soundings. This apparent anomaly arises from the fact that the extreme heights of the land are exceptional and confined to a small part of its surface; while the ocean maintains its great depth over enormous areas. It is evident that, during the recent periods of the earth's history, there have been great subsidences and elevations of the land; many raised beaches are 1000 to 1200 feet above sea-level. Dana, following Darwin's theory of atoll formation, terms the atoll a memorial of a departed land, and considers that the great Pacific subsidence was contemporaneous with the post-glacial upheaval in the north" (p. 123).

The volume concludes with three brief appendices, giving (a) a useful account of the common rock-forming minerals, (b) a classification of plants, and (c) of animals, both living and fossil.

The name of each mineral is conveniently printed in blacker type than the rest of the text, so as more readily to catch the eye. The names of the extinct orders of plants and animals are similarly printed in blacker type.

In appendix (c) there are a few errata, which should be corrected in a future edition. For instance, the worms of various kinds appear under two headings; nine orders being arranged in Series V. (p. 609), under Annuloidea, and four other orders have crept into Series VIII. under Arthropoda (on p. 610). On the same page "May-flies" are given as an example of Orthoptera instead of *Blatta* or *Mantis*. The Phyllocarida (represented by *Nebalia*, *Ceratiocaris*, &c.) have been accidentally omitted; also Schizopoda and Cumacea.

In the Reptilia, Proterosauria and Procolophonina are left out; and for Orthopoda, we would suggest Ornithopoda (bird-footed) as more correct. For Odontornæ (p. 612) read Odontormæ. Under Mollusca (on p. 609), by using the terms Gastropoda and Pulmonata, the student is in danger of supposing that snails are not gasteropods, whereas the Pulmonata are only a *sub-division* of the Gastropoda.

We have only referred to this last appendix because it is stated (on p. 612) that the classification followed is that of Huxley, E. T. Newton, and Zittel; but no one would for a moment wish these authors to be held responsible for misprints which have accidentally crept into the table in its present form.

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It is to be regretted that the classification of the fishes, followed by Prof. Judd, is that of Prof. Zittel, which is now considerably modified by the later arrangement (1896) of Mr. Arthur Smith Woodward. In this latest work we find that *Pteraspis*, *Cephalaspis*, *Pterichthys*, &c., are placed in a distinct division of armoured noto-chordal animals, the Ostracodermi; while the old division Placodermi, is broken up; the Arthrodira (*Coccosteus-like-fishes*) alone remaining. In a similar manner the Actinopterygian order has replaced the old order Ganoidei, which has disappeared.

We have already spoken in commendation of the great abundance and excellence of the illustrations (more than 700 in number) which adorn the present work; we may, however, venture to take exception to the figures of *Cephalaspis Lyelli* (p. 380) and of *Pterichthys* (p. 382). Page's figure should be replaced by the careful restoration by Prof. Ray Lankester, and Hugh Miller's *Pterichthys* by Dr. R. H. Traquair's elegant and accurate figures of that remarkable genus.

Time and space alike preclude us from doing fuller justice to this excellent text-book; but we feel assured it will live on and be read not only by many geological students, but by a large section of the English public who still hold the name of Lyell in high estimation and value his teachings. Thus will this little volume serve to keep alive the memory of one who was, perhaps, the greatest geological writer and expositor of this century.

BOULENGER'S CATALOGUE OF SNAKES.

Catalogue of the Snakes in the British Museum (Natural History). Vol. III. Containing the Colubridæ (Opisthoglyphæ and Proteroglyphæ), Amblycephalidæ, and Viperidæ. By George Albert Boulenger, F.R.S. Pp. xiv + 727, 25 plates. (London: Printed by Order of the Trustees, 1896.)

WITH the issue of the present volume Mr. Boulenger completes his examination and description of the herpetological collections in the British Museum, which have occupied his attention for more than fourteen years. The whole series of Catalogues thus brought to a conclusion consists of nine volumes. Two of these, issued in 1882, are devoted to the Batrachians, with the study of which Mr. Boulenger commenced his labours in our National Museum, three to the Lizards (1885-87), one to the Rhynchocephalians, Chelonians, and Crocodiles (1889), and finally three to the Snakes. The enormous series which has thus been examined, classified, and catalogued consists of 38,086 specimens. These have been referred by Mr. Boulenger to 3905 species, while 1265 others, which are allowed by the author to be valid, but are not represented in the British Museum, raise the total number of known species of Batrachians and Reptiles to 5170. While it is thus evident that our great National Institution is not without its deficiencies, there can be no doubt whatever that as regards its herpetological collections, when compared with similar institutions on the continent and elsewhere, it stands absolutely unrivalled. The collection of Reptiles and Batrachians at South Kensington is "not only the largest but also the best arranged in existence, every specimen of it having been carefully examined and classified according to a modern

system after consultation of the whole literature of the subject." Moreover, the so-called "Catalogues" are not mere lists of specimens, but, as we are assured by the Director in his preface to the last volume of the series, are "complete monographs of the groups of animals treated of, so far as their zoological characters, geographical distribution and synonymy are concerned, descriptions being given of every species regarded by the author as valid, whether represented in the Museum or not." It is not too much to say that no more arduous or more important piece of zoological work has been brought to a successful issue, in modern days, than that which has been thus accomplished by the unremitting devotion of the author of these Catalogues to his task during the past fifteen years.

With regard to the Ophidians or Snakes, which are more immediately the subject of the present notice, Mr. Boulenger has had a specially difficult subject to deal with. Next to the Lizards the Snakes are the most numerous Order of Reptiles. But while the Lizards present many well-marked characters for their division into subordinate sections, the great mass of Snakes belong essentially to one extensive group which Mr. Boulenger allows only to rank as a family. Out of the whole number of 1639 species of Snakes recognised as valid in the present work, upwards of 1250 species are referred to the Colubridæ. The proper treatment of this family is one of the most embarrassing questions for the Herpetologist. The formerly recognised division of Snakes into Venomous and Non-venomous is altogether discarded by the author, who takes the structure of the skull and other anatomical characters as his guide. The great family Colubridæ embraces venomous as well as innocuous species; indeed, the poison of some of the Proteroglyphous Colubridæ (such as the Cobras and Hydrophids) is quite as deadly as that of the Vipers and Rattlesnakes. In another work, recently published, Mr. Boulenger has spoken as follows upon this subject:—

"A general desire is felt by those not well acquainted with Snakes to be able to distinguish at a glance between harmless and poisonous forms. To meet this requirement various criteria have been proposed, none of which, however, are satisfactory. It is well to state at once that there is no sure method of distinguishing the two forms by external characters, except of course a knowledge of the various forms. And even then a cursory examination is not always sufficient, since there is, in some cases, a striking resemblance between Snakes of totally different affinities, by which even specialists may be at first deceived. In short, nothing but an examination of the dentition can afford positive information as to the poisonous or non-poisonous nature of an unknown Snake."

Mr. Boulenger divides the Ophidians as a whole into nine families. He commences his systematic arrangement with the small worm-like Typhlopidae, which pass their lives in burrows beneath the earth. They are numerous under the tropics, upwards of 100 species being already known, and many more in all probability awaiting discovery. The allied family Glauconiidae, of which twenty-nine species are registered, has similar habits. Next to these come the Boas and Pythons (Boidæ) with sixty-six species, amongst which are the monsters of the Ophidian Order. *Python reticulatus*, of the Malay countries, is

said to attain a length of thirty feet, and the Anaconda of tropical forests of South America to arrive at still larger dimensions. Of the small family Ilysiidae, which is intermediate between the Boas and the Earth-snakes (Uropeltidae) only five species, belonging to three genera, are known, two of these being East Indian, while one, strange to say, is South American. The Uropeltidae, on the other hand, offer us an example of an extremely limited distribution, the whole of the forty-two known species being restricted to the mountains of Ceylon and the Indian peninsula, where they are frequently dug up in the plantations of Tea and Coffee. The sixth family of Snakes, according to Mr. Boulenger's system, consists only of the anomalous *Xenopeltis unicolor*, of India and the Malayan countries, while the seventh family, the Colubridæ, as we have already mentioned, is by far the most numerous of all, containing, in fact, more than three-fourths of all the known species of Ophidians. Mr. Boulenger divides this enormous "family" into "three parallel series"—Aglypha, Opisthoglypha, and Proteroglypha. The first of these, with solid teeth, are harmless; the last, with the anterior maxillary teeth grooved or perforated, are venomous; while the Opisthoglyphs, with the posterior maxillary teeth grooved, are all to be suspected, and usually more or less poisonous. The highly venomous Proteroglyphs are followed, although they do not lead into the typical venomous Serpents with erectile maxillary, which Mr. Boulenger unites into one family—Viperidae—classing the Pit-vipers and Rattlesnakes only as a distinct sub-family. This is his ninth and last group of Ophidians. Between it and the Colubridæ, he locates as an eighth family the Amblycephalidae, the members of which have but little power of expanding the mouth, and feed on insects and other small prey. Of Amblycephalidae, thirty-four species are characterised and referred to five genera.

Whatever objections may hereafter be taken, and in some cases perhaps maintained, against Mr. Boulenger's rather revolutionary scheme of the classification of Snakes, there can be no question that his "Catalogue" makes a most distinct and remarkable advance in our knowledge of these animals, and will in future be employed by herpetologists all over the world for the arrangement of their collections, and as a solid base for future research. In the case of the "Catalogue of Birds," now nearly brought to a completion in the same zoological workshop, it has been found necessary to employ many different authors whose discordant views result in a somewhat incongruous whole. But herpetology has been more fortunate than ornithology in finding a naturalist of conspicuous ability and untiring patience who has achieved the feat of arranging and classifying all the subjects under his charge upon a uniform system.

THE MANAGEMENT OF PUBLIC WORKS IN THE UNITED STATES.

The United States Public Works Guide and Register.

By Captain W. M. Black. Pp. vi + 276. (New York: Wiley and Sons. London: Chapman and Hall, 1895.)

THE public works of the United States are in charge of officers working under different bureaux of the executive departments of the Government. All harbour,